

Perceived coach-autonomy support, basic need satisfaction and the well- and ill-being of elite youth soccer players: A longitudinal investigation

Adie, J.W. , Duda, J.L. and Ntoumanis, N.

Author post-print (accepted) deposited in CURVE July 2013

Original citation & hyperlink:

Adie, J.W. , Duda, J.L. and Ntoumanis, N. (2012) Perceived coach-autonomy support, basic need satisfaction and the well- and ill-being of elite youth soccer players: A longitudinal investigation. *Psychology of Sport and Exercise*, volume 13 (1): 51–59.

<http://dx.doi.org/10.1016/j.psychsport.2011.07.008>

Please note James Adie was working at the University of Birmingham at the time of publication.

Copyright © and Moral Rights are retained by the author(s) and/ or other copyright owners. A copy can be downloaded for personal non-commercial research or study, without prior permission or charge. This item cannot be reproduced or quoted extensively from without first obtaining permission in writing from the copyright holder(s). The content must not be changed in any way or sold commercially in any format or medium without the formal permission of the copyright holders.

This document is the author's post-print version of the journal article, incorporating any revisions agreed during the peer-review process. Some differences between the published version and this version may remain and you are advised to consult the published version if you wish to cite from it.

CURVE is the Institutional Repository for Coventry University

<http://curve.coventry.ac.uk/open>

Running head: PSYCHOLOGICAL NEED SATISFACTION AND WELL-BEING

Adie, J., Duda, J.L., & Ntoumanis, N. (2012). Perceived coach autonomy support, basic need satisfaction and the well- and ill-being of elite youth soccer players: A longitudinal investigation.

Psychology of Sport and Exercise 13, 51-59.

Research Highlights

- Perceived coach autonomy support positively predicted within-person changes in basic need satisfaction and subjective vitality.
- Competence and relatedness need satisfaction were positively associated to within-person changes in subjective vitality.
- Competence and relatedness need satisfaction partially mediated the longitudinal relationship between perceptions of coach autonomy support and subjective vitality among elite youth male soccer participants.
- The findings partially support the tenets of basic needs theory (Ryan & Deci, 2000) in an elite youth soccer setting across two competitive seasons.

Abstract

Objectives: Drawing from the Basic Needs Theory [BNT; Ryan, R. M., & Deci, E. L. (2002). An overview of self-determination theory. In E. L. Deci & R. M. Ryan (Eds.), *Handbook of self-determination research* (pp. 3-33). Rochester, NY: University of Rochester Press], the major purpose of the present study was to test a hypothesized sequence of temporal relationships between perceptions of coach autonomy support, basic need satisfaction and indices of well- and ill-being. A subsidiary aim was to ascertain the assumed mediational role of basic need satisfaction in explicating the perceived autonomy support and well-/ill-being relationships over time.

Method: Participants (N = 54 males) from an elite youth soccer academy in the UK completed a multi-section questionnaire tapping the targeted variables on six occasions across two competitive seasons.

Results: Multi-level regression analyses revealed that perceptions of coach autonomy support positively predicted within-person changes and between-person mean differences in basic need satisfaction and well-being over time. Satisfaction scores for the needs for competence and relatedness were found to predict within-person changes in subjective vitality. These same needs partially mediated the coach autonomy support-subjective vitality link over the two seasons.

Conclusions: The findings partially support the tenets of BNT, and are discussed in terms of their practical application to participants involved in an elite youth sport setting.

Keywords: perceived coach autonomy support, self-determination, multi-level regression, sport motivation, optimal functioning.

Perceived Coach Autonomy Support, Basic Need Satisfaction and the Well- and Ill-Being of Elite Youth Soccer Players: A Longitudinal Investigation

Long term healthy participation in competitive sport programs is more likely when the participant is functioning optimally and experiencing physical, emotional and psychological well-being. In contrast, if an athletes' sport experience is marked by ill-health, then there is a considerable risk of damaging his/her immediate and long term physical and psychological development through continued training and competition (e.g., Krane, Greenleaf & Snow, 1997). One significant figure influential in shaping the welfare and optimal functioning of sport participants is the coach (e.g., Duda & Balaguer, 2007; Reinboth & Duda, 2004). To this end, researchers have begun to elicit the mechanisms linking variations in the perceived coaching environment to indices of well and ill-being among participants in the sport domain (e.g., Adie, Duda & Ntoumanis, 2008; Reinboth, Duda & Ntoumanis, 2004). Grounded in the basic needs theory (BNT; Ryan & Deci, 2002), the main aim of the present study was to examine the motivational processes underpinning the hypothesized relationships between the perceived coaching environment and indices of psychological/emotional functioning among young elite soccer players over a two-year period.

BNT (e.g., Ryan & Deci, 2002), a mini-theory of self determination theory (SDT; Deci & Ryan, 1985), is a conceptual framework useful for understanding the implications of the perceived social environment on participant well-being. More specifically, BNT posits that humans possess three innate psychological needs which provide the essential nutriments necessary for growth and positive development (e.g., Deci & Ryan, 2000). The first of these needs, autonomy, is experienced when people feel a sense of volition regarding their choices and decision-making in the context at hand (Deci & Ryan, 1985). The autonomy need is also fulfilled when individuals perceive their actions are congruent with their integrated sense of self (deCharms, 1968). The need for competence is satisfied when individuals perceive the capacity to assert influence, and master tasks within their social environment (White, 1959). Finally, the relatedness need is met when humans feel a sense of belongingness to and by others in a particular context (Baumeister & Leary, 1995).

BNT assumes that satisfaction of the three basic needs via interactions with the social environment can promote optimal functioning (Deci & Vansteenkiste, 2004). In contrast, frustration of one or all of these needs by the perceived social environment is postulated to undermine well-being and can lead to the deterioration of one's health (Ryan & Deci, 2000; 2002). In sum, BNT views the three psychological needs to mediate the links between facets of the perceived social environment and well- and ill-being (Deci & Ryan, 2000).

Aligned with SDT (e.g., Ryan, Huta & Deci, 2008), the present study embraced the eudaimonic perspective on well-being. Eudaimonism is characterized by personal development, meaningful engagement and optimal functioning (see Ryan & Deci, 2001; Waterman, 1993). According to this perspective (e.g., Waterman, 1993), eudaimonia is realised in the pursuit of actualising human potential. In the context of the current research, the soccer participants were considered fully functioning when reporting a heightened sense of positive energy, whereas players experiencing ill-being/diminished functioning were marked by a perceived loss of energy, or feeling emotionally and physically exhausted. Thus, we measured subjective vitality (Ryan & Frederick, 1997) as an indicator of eudaimonic well-being, and emotional and physical exhaustion (Raedeke & Smith, 2001) as a reflection of ill-being.

One aspect of the perceived social environment postulated to influence the degree of psychological need satisfaction, and in turn eudaimonic well-being, is autonomy support (Deci & Ryan, 1987; Ryan & Solky, 1996). Autonomy support is provided when an authority figure is ready to take the participants' perspective into account, acknowledges the others feelings, promotes choice and decision-making, and supplies meaningful information whilst minimizing external demands (e.g., Mageau & Vallerand, 2003). Aligned with theoretical predictions, perceptions of autonomy support created by significant others (e.g., coach, teacher) have been found to predict basic need satisfaction in research conducted in sport (e.g., Smith, Ntoumanis & Duda, 2007), physical education (PE; e.g., Standage, Duda, & Ntoumanis, 2006) and exercise (e.g., Edmunds,

Ntoumanis & Duda, 2007) settings as well as other life contexts (e.g., education; Ratelle, Larose, Guay, & Senécal, 2005).

Testing of the hypothesized perceived social environment → basic needs → well-/ill-being BNT motivational sequence has received some empirical attention in the physical domain (e.g., Adie et al., 2008; Reinboth et al., 2004). A study conducted by Reinboth et al. (2004) found that different aspects of the perceived coach-created environment (e.g., the perceived autonomy supportive, mastery-focused and social supportive features) emerged as positive predictors of the needs for autonomy, competence and relatedness, respectively, in a sample of adolescent male athletes. In turn, perceptions of autonomy, and competence particularly, were positively associated with subjective vitality and intrinsic interest in their chosen sport. The study findings also showed that athletes' need for competence was inversely linked to their reported symptoms of physical ill-health.

Extending the work of Reinboth and colleagues (2004), Adie et al. (2008) demonstrated partial gender invariance of a hypothesized model with respect to the assumed relationships between perceptions of coach autonomy support, basic need satisfaction and indices of well- and ill-being (i.e., subjective vitality, emotional and physical exhaustion) among young adult sport participants. Furthermore, the hypothesized mediational role of the basic needs in explicating the perceived autonomy support-subjective vitality relationship was partially supported. In particular, autonomy and competence need satisfaction were observed to partially mediate the association between perceived autonomy support and subjective vitality.

The findings stemming from such cross-sectional studies mainly corroborate the assumptions of BNT (Ryan & Deci, 2002). Cross-sectional studies are only useful for testing between-person differences, and cannot capture the dynamic interrelationships in the motivational sequence assumed by BNT (e.g., Ryan & Deci, 2002). As such, cross-sectional studies cannot be used to examine how changes in motivational processes relate to changes in well-/ill-being over time. To address this issue, and advance the existing BNT sport-based research (e.g., Adie et al.,

2008), it is critical to ascertain if longitudinal patterns of change in markers of well- and ill-being among athletes occur as a function of change in basic need satisfaction and the perceived social environment over time.

Only a few studies have employed longitudinal research designs to test the postulates of BNT (Ryan & Deci, 2002) in the physical domain. Reinboth and Duda (2006), for example, found variation over time in the task-involving features (i.e., emphasizing high effort, cooperation and equality) of the coach-created climate to positively predict residual change in subjective vitality via satisfaction of the needs for autonomy and relatedness. The observed changes in subjective vitality accounted for by change in a task-involving climate were witnessed from the beginning to the end of a competitive season among student-athletes involved in team sports. One major problem with two-wave designs is that the development trajectories of the participants are restricted to the investigation of linear change only (i.e., increased, decreased, none; see Singer & Willett, 2003). In the context of sport, it is also possible to envisage the trajectories of athletes changing in a non-linear fashion over time. For example, athletes may report fluctuating levels of healthy and unhealthy sport participation over the course of a season(s) but without including more assessment periods (i.e., at least four time points; Singer & Willett, 2003) non-linear change can not be estimated.

In light of this issue, Gagné, Ryan, and Bargmann (2003) conducted a diary based study measuring motivational constructs and their relationship to the quality of involvement among adolescent female gymnasts over a 15-day training period in the off-season. Gagné and her associates found daily fluctuations in basic need satisfaction to account for daily within-person changes in well-being from pre- to post-practice over time. In terms of testing the assumed antecedent role of perceived autonomy support, Gagné et al. could only examine between-person variation on daily need satisfaction and well-being because autonomy support was not measured as a time-varying predictor in this study.

Building on the limited longitudinal BNT-based work in the physical domain (e.g., Gagné et al., 2003; Reinboth & Duda, 2006), the present study examined the hypothesized sequence of relationships between perceptions of coach autonomy support, basic need satisfaction and the well- and ill-being of young elite male soccer participants over two competitive seasons. The complete BNT sequence has not yet been investigated among a young elite male sample, and over such a prolonged period of time (i.e., two competitive seasons). It is important to consider this sequence of relationships beyond a single season because it could have implications for coaches to understand ways of sustaining young elite players' healthy participation in sport over the course of one competitive season to the next. Thus, the present study represented a unique opportunity to track the linear, non-linear and discontinuous change in the psychological and emotional functioning of male participants involved in an elite youth soccer academy over a two year period.

Specifically, the aims of the present study were fivefold. First, the potential changes in the trajectories of the well- and ill-being outcomes were examined over the two year period. Second, within-person changes and between-person mean differences in these trajectories were tested as a function of perceived coach autonomy support. Third, the assumed temporal patterns of perceived coach autonomy support predicting the three basic psychological needs were determined. Fourth, the hypothesized predictive effects of perceived coach autonomy support and the basic psychological needs on indices of well- and ill-being over time were ascertained. Lastly, the mediational role of the psychological needs in explicating the perceived autonomy support and well-/ill-being links was explored across the two years.

Method

Participants

At the beginning of the investigation, participants were 91 male adolescent soccer players ($M_{\text{age}} = 13.82$; $SD = 1.99$; range = 11-18 years) from a School of Excellence (SoE) based in the West Midlands, UK. Approximately half of the study participants were in their first season ($n = 40$), thirteen players in their second, and thirty-eight players had completed three or more seasons at the

SoE. On average, players had known their coach for at least a year ($M = 1.33$; $SD = .65$ years).

Thirty-seven of the volunteers did not complete the study for the following reasons: cut from the team ($n = 23$); dropped-out ($n = 6$); promoted to the 1st team ($n = 5$); sustained long term injury/illness ($n = 2$); and unknown ($n = 1$).

Procedures and Design

Aligned with the work of Adie, Ntoumanis and Duda (2010), the Youth Director of a professional soccer club invited us to conduct an investigation into the motivational-related predictors of well-/ill-being among the male adolescent players involved in their SoE program. The major aim of the SoE is to develop young talented soccer players into professionals upon completion of the program. The earliest a player could be recruited by the SoE was at the age of seven (i.e., U8's team). No players under the age of 11 years were targeted for participation in the present study on the basis that their training and competitive games were structured differently (i.e., the U8-11's played 8-a-side games) compared to the other teams in the SoE. Instead, players from the U12-16's and youth team (i.e., players aged 16-18 years old) were considered for participation (i.e., all played 11-a-side matches). The players from the selected teams were registered within the SoE on either an annual (i.e., U12-16's) or biennial (i.e., youth team) basis. Finally, registered players were not permitted to play for an outside soccer club whilst being members of the SoE.

Following University ethical approval, a letter was sent to eligible players, their head coach and parents detailing the purpose and protocol of the study. At a pre-season open evening, parental and coach consent was obtained along with written assent from the players. APA guidelines regarding anonymity and confidentiality were followed. At the time the study commenced, all players ($N = 91$) registered with the SoE volunteered to participate. The study aimed to collect data from these same participants across two competitive soccer seasons. The principal researcher administered a multi-section questionnaire measuring perceived coach autonomy support, basic need satisfaction and well-/ill-being at the beginning, middle and end of both seasons (i.e., waves 1-6). The questionnaire was completed by participants from each team in an indoor club setting at

each wave. No data were collected from players that left or joined the SoE program after the first wave of measurement.

Measures

Perceived coach autonomy support. Seven items from the Health Care Climate Questionnaire (HCCQ; Williams, Grow, Freedman, Ryan, & Deci, 1996) were adapted to tap the degree to which players perceived their head coach to be autonomy supportive. Participants responded to the stem, “On this soccer team...” Example items are “I feel that my coach provides me with choices and options”, and “My coach listens to how I would like to do things”. The responses were anchored on a scale of 1 (*strongly disagree*) to 7 (*strongly agree*). Previous research conducted in the physical domain has supported the internal reliability and predictive validity of the adapted seven-item version of the HCCQ (e.g., Reinboth et al., 2004; Smith et al., 2007).

Basic psychological needs. To capture satisfaction of the autonomy need, three items were adapted from a measure employed by Sheldon, Elliot, Kim and Kasser (2001; e.g., “My choices express who I really am”). The competence need was assessed by slightly adapting the five-item perceived competence subscale of the Intrinsic Motivation Inventory (McAuley, Duncan & Tammen, 1989). An example item is, “I think I am pretty good (e.g., at soccer)”. Lastly, the acceptance subscale of the need for relatedness scale (Richer & Vallerand, 1998) was employed to measure perceptions of the players’ perceived degree of connectedness to their team (e.g., “I feel supported”). Items were preceded by the stem, “On this team...” and participants reported their answers on either a five point- (autonomy, relatedness) or a seven-point scale (competence), ranging from *strongly disagree* to *strongly agree*. Past sport research has supported the internal consistency and predictive validity of these measures (e.g., Adie et al., 2008; Reinboth & Duda, 2006).

Well-/ill-being outcomes. The six-item Subjective Vitality Scale (SVS; Ryan & Frederick, 1997) was employed to measure the players’ feelings of possessing positive energy. That is, the SVS was used to capture the extent to which players felt alive and energetic in their soccer

participation (e.g., “I feel alive and full of energy”). Responses were provided on a seven-point scale (1 = *strongly disagree*; 7 = *strongly agree*). Sport research has supported the predictive validity as well as the internal reliability of this scale (e.g., Gagné et al., 2003; Reinboth et al., 2004).

The emotional and physical exhaustion facet of the Athlete Burnout Questionnaire (ABQ; Raedeke & Smith, 2001) was used to measure the frequency by which players perceived very low energy levels in soccer. A sample item is “I feel so tired from soccer training that I have trouble finding energy to do other things”. Participants answered on a five-point scale (1 = *almost never*; 5 = *almost always*). Previous research has provided evidence for the construct validity and internal reliability of this measure (e.g., Lemyre, Roberts & Treasure, 2006).

Data Analysis

Prior to conducting the main analyses, it was necessary to consider the extent and treatment of missing data. Two types of missing data were observed in the present study. First, individual scores for some items were missing. According to Tabachnick and Fidell (2007), when less than 5% of data points are missing from the data set in an unsystematic fashion, then almost any method for handling missing values yields similar results. We chose not to replace these scores as the amount of missing data was small and because the statistical software program (i.e., MLwiN 2.10) employed in the present study can handle missing data. Second, missing waves of data were observed for some participants. If players were recorded absent at training then times were immediately arranged to re-visit the SoE to collect the missing participants’ data. By adopting this strategy, we managed to minimize the amount of attrition in the study. However, the data set contained missing waves of data for the players ($n = 37$) who did not finish the study. Repeated measures ANOVA’s were carried out to discern the potential main and interactive effects of time (season one only) and program attendance (i.e., full versus discontinued participation) on perceived coach autonomy support, the basic psychological needs, and the well- and ill-being outcomes. Only the players cut from the team or who dropped out in the second season were classified as the

discontinued participation group. The other players without data for the second season were not included in this analysis because they were still part of the soccer club but inaccessible (i.e., promoted to the 1st team, injured).

The main analyses were performed using multi-level regression techniques (MLwiN, 2.10; Rasbash, Steele, Browne, & Goldstein, 2009). Multi-level regression is the choice of statistical analysis when the data take the form of a hierarchical nature (see Singer & Willett, 2003). Similar to another motivational study in sport (Adie et al., 2010), the present longitudinal design had a two-level hierarchical structure with repeated measurements (Level 1) nested within individuals (Level 2). Multi-level regression modeling accounts for change in targeted outcomes as a result of time-varying (or time-invariant) predictors. The present study consisted of time-varying predictors only, which were perceived coach autonomy support and the basic psychological needs for autonomy, competence and relatedness. These variables were centered on each individual's unique mean over time (i.e., group mean centering) and entered onto the Level 1 equations. This form of centering removes invariant effects of the participant, leaving only deviations from their own unique mean. These sets of equations tested whether within-person changes in perceptions of coach autonomy support and basic need satisfaction would predict within-person changes in well- and ill-being. We also entered the individuals' mean scores, averaged across time, onto the Level 2 equations. The Level 2 equations allowed us to examine whether between-person mean differences across the two seasons in autonomy support and basic need satisfaction predicted between-person mean differences in well- and ill-being across both seasons. Time was centered at wave one.

Model A was used to explore potential changes in the slope (i.e., rate of change) of the well- and ill-being outcomes (as well as the other study variables), and whether these changes were linear and/or quadratic. A series of models were then estimated with perceptions of coach-autonomy support and the three basic needs predicting within-person change and between-person mean differences in the indices of well- and ill-being. More specifically, Model B regressed each well- and ill-being outcome onto athletes' perceptions of coach autonomy support. Model C specified the

hypothesized effects of perceived coach autonomy support on the basic need satisfaction variables over time. Model D examined the temporal role of the basic need satisfaction variables (controlling for perceived autonomy support) on well- and ill-being. The interactions with the slope for time (i.e., linear and quadratic terms) were also determined in Models B to D. Lastly, the potential mediational effects of the three basic needs explaining the hypothesized coach autonomy support and well-being relationship (i.e., Model B) were also examined in Model D (see Baron & Kenny, 1986).

Results

Descriptive Statistics and Pearson Correlations

The means and internal reliabilities of the study variables are presented in Table 1. The participants reported high levels of perceived coach autonomy support, subjective vitality and the needs for competence and relatedness on each occasion. Moreover, moderate levels of the need for autonomy were exhibited, whereas emotional and physical exhaustion scores were low across all waves of assessment. The internal reliability values of the study variables at each assessment were high. This was the case for nearly all the scales except for the one measuring the need for autonomy. The Cronbach's alpha coefficient for this measure was below .70 for waves one to three, but adequate for all other assessment periods. Also displayed in Table 1 are the bivariate correlations for each measurement wave, in addition to the average correlations across all waves. The correlations were all in the expected directions.

Program Attendance and Time Effects

We examined the main effects and interaction of program attendance (i.e., full versus discontinued participation) and time on perceptions of coach autonomy support, basic psychological needs, and our indices of well- and ill-being. These particular analyses could only be performed on season one time points (i.e., waves 1-3) as there were insufficient data points to draw comparisons with the participants leaving the program in the second season. The main and interaction effects for program attendance emerged non-significant on all the targeted variables. However, there was a

main effect for time concerning emotional and physical exhaustion ($F(2, 69) = 4.68; p < .01$). A closer examination indicated a linear increase in exhaustion over the course of season one.

Main Analyses Overview

In the present study, the data set was unbalanced in that a number of participants left the program (in particular after season one). Since we were interested to examine the trajectories of change of the study variables, this systematic pattern of missing data was problematic (see Singer & Willett, 2003). Thus, we focused on only those participants with complete data across the two seasons. Fifty-four participants had complete data across the six waves. The current sample size is in accordance with simulation data that recommend fifty or more units at level two in a multi-level model (Maas & Hox, 2005).

Unconditional Model (Model A)

The findings revealed a linear increase in subjective vitality ($B = .25; p < .05$) over the two seasons. For emotional and physical exhaustion, there was a significant linear increase ($B = .35; p < .01$), and a significant quadratic effect ($B = -.04; p < .05$) in the slopes for time. No other significant findings emerged.

Perceived Autonomy Support Predicting Well- and Ill-Being (Model B)

The results of Model B indicated that perceived coach autonomy support predicted within-person changes ($B = .37; p < .001$) and between-person mean differences ($B = .47; p < .001$) in subjective vitality. In other words, the results of the within-person associations (i.e., Level 1 equations) showed that increases over the two seasons in perceived coach autonomy support corresponded with increases over the two seasons in feelings of perceived positive energy emanating from the self. The findings concerning between-person mean differences (i.e., Level 2 equations) suggested that players who perceived the coach to be more autonomy supportive across both seasons also experienced more subjective vitality across the same period. In terms of emotional and physical exhaustion, between-person mean differences in coach-autonomy support served as a negative predictor ($B = -.39; p < .001$). Perceptions of coach-autonomy support did not

explain within-person variation in reported emotional and physical exhaustion over time. However, significant interactions emerged between perceived coach-autonomy support and the linear ($B = .30; p < .05$) and quadratic ($B = -.04; p < .05$) time terms in the prediction of emotional and physical exhaustion. The hypothesized interactions concerning subjective vitality were not significant.

Perceived Autonomy Support and Basic Need Satisfaction (Model C)

The findings in Model C showed that change in each of the three needs was predicted by variation over time in perceived coach autonomy support. More specifically, perceived coach autonomy support positively predicted both within-person changes and between-person mean differences in the needs for autonomy ($B = .22; p < .001; B = .37; p < .001$), competence ($B = .20; p < .001; B = .25; p < .01$) and relatedness ($B = .07; p < .001; B = .50; p < .001$) over the course of the two seasons. The interactions between perceptions of coach autonomy support and the slopes for time in the prediction of the three needs were all non-significant.

Basic Need Satisfaction (Controlling for Perceived Autonomy Support) Predicting Well- and Ill-Being (Model D)

Model D tested the temporal relationships between the three basic needs and the indicators of well- and ill-being, controlling for perceptions of coach autonomy support. The results are presented in Table 2. For subjective vitality, within-person variation was explained by the needs for competence and relatedness ($p < .001$), but not the autonomy need ($p > .05$). No significant within-person associations emerged between the basic psychological needs and emotional and physical exhaustion ($p > .05$). Between-person mean differences in the three psychological needs were unrelated to between-person mean differences in subjective vitality and emotional and physical exhaustion ($p > .05$). However, there was a significant interaction between the relatedness need and the quadratic term for time in the prediction of emotional and physical exhaustion ($p < .05$).

Mediational Effects

To test and establish mediation, researchers recommend the following three steps (Baron & Kenny, 1986). First, the predictors must be associated with the outcome variables. The second

condition indicates that the predictors must be related to the mediators. In the third condition, the mediators must relate to the outcome variables whilst controlling for the predictors. These steps were tested in Models B to D. According to the present results, it was possible to test mediation with respect to perceptions of coach autonomy support predicting within-person changes in subjective vitality.

Aligned with Baron and Kenny (1986), the final mediational step was to examine the direct effects of the predictor on the outcome, whilst controlling for the mediators. In the present study, we were interested as to whether the regression coefficients between perceived coach autonomy support and subjective vitality (i.e., Model B) reduced when controlling for the mediators (i.e., in the present case, the competence and relatedness needs). Full mediation is inferred when the regression coefficient of the direct effect is reduced to zero, whereas partial mediation is supported if there is only a reduction in the coefficient whilst controlling for the mediators (Baron & Kenny, 1986). The results showed that the regression coefficient representing the direct link between perceptions of coach autonomy support and subjective vitality dropped when controlling for the psychological needs ($B = .37$ to $.25$; $p < .001$). Significant indirect effects were found with respect to perceived coach autonomy support predicting within-person changes in subjective vitality via the needs for competence ($B = .05$; $p < .01$) and relatedness ($B = .02$; $p < .05$).

Discussion

Grounded in the BNT framework (Ryan & Deci, 2002) and extending past findings (e.g., Adie et al., 2008; Gagné et al., 2003), the present study partially supported a longitudinal motivational sequence of hypothesized relationships between perceptions of coach autonomy support, basic need satisfaction and eudaimonic well-being in a sample of young elite soccer players.

Stability and Change Among Perceived Autonomy Support, Basic Need Satisfaction and Well- and Ill-Being

Contrary to previous research (e.g., Edmunds et al., 2007; Reinboth & Duda, 2006), autonomy support and the three psychological needs remained at moderate to high levels and stable across the two competitive seasons among the adolescent soccer players in the present study. These results may be a testament to the way the soccer program was implemented at this particular SoE. That is, the observed means for perceived coach autonomy support and satisfaction of players' needs for competence, autonomy and relatedness suggest that this SoE was a relatively positive and adaptive place for these talented players to further their soccer skills.

The results also indicated that participants reported increased levels of subjective vitality and emotional and physical exhaustion across both seasons. However, it is important to note that levels of emotional and physical exhaustion were low, whereas vitality was moderately high, at the beginning of season one before rising moderately and stabilising by the end of season two. The findings suggest that the longer the players stayed in the SoE program the more they experienced feelings of positive energy, and adapted to the physical and emotional demands of training and competition. Thus, it is plausible that the players' feelings of vitality (and to some extent, exhaustion) increased as a result of overcoming the continuous challenges faced in the SoE (e.g., increased training) and by deeming their long term aspirations (e.g., turning professional) as becoming more of a reality.

Perceived Autonomy Support and Well- and Ill-Being

In line with our hypotheses and past findings (e.g., Adie et al., 2008; Kasser & Ryan, 1999), the perceived autonomy supportive environment was positively related to subjective vitality. More specifically, the results suggest that increased within-person perceptions of coach autonomy support corresponded to within-person increases in positive energy and feelings of aliveness over time. The findings also indicate that changes in subjective vitality are explained by between-person mean differences in a coaching environment deemed to be high in its autonomy supportive features. The findings indicate the importance of a coaching environment that continually fosters the athletes'

perspective, conveys trust in their abilities, and initiates their choices and decision-making in terms of sustaining optimal functioning in a youth sport setting.

Interestingly, and in contrast to past findings (e.g., Adie et al., 2008), players' perceptions of coach autonomy support was found to explain between-person mean differences in emotional and physical exhaustion across two seasons. The present finding suggests that a perceived coaching environment that continually solicits input and decision-making from the athlete has implications in terms of reducing symptoms of burnout (e.g., see Raedeke & Smith, 2001) during long term investment in sport. However, associations of within-person changes between perceptions of coach autonomy support and emotional and physical exhaustion did not emerge.

Other dimensions of the social environment, besides perceived autonomy support, could be relevant to within-person variability in emotional and physical exhaustion. Past youth sport research has observed links between athletes' perceptions of a controlling environment created by significant others (e.g., parents, coaches) and symptoms of burnout among junior tennis players (e.g., Gould, Tuffey, Udry & Loehr, 1996; Reinboth & Duda, 2004). One reason for the dearth of sport research with respect to this area has been the absence, until recently, of a validated measure to capture the more or less controlling interpersonal style of the coach (Bartholomew, Ntoumanis, & Thøgersen-Ntoumani, 2010). Thus, future research can now examine the role concerning perceived controlling aspects of the social environment on diminished functioning.

Perceived Autonomy Support and Basic Need Satisfaction

Extending cross-sectional work conducted in the sport domain (e.g., Adie et al., 2008; Smith et al., 2007), we found perceived coach autonomy support to positively predict within-person changes and between-person mean differences in the psychological needs for autonomy, competence and relatedness among the soccer participants. That is to say, the higher the degree of coach autonomy support perceived by the players then the higher the level of change in basic need satisfaction exhibited over time. The results also suggest that those soccer players who perceived

the coach-created environment to be more autonomy supportive across the two seasons also witnessed higher levels of basic need satisfaction.

The present study provides further evidence that corroborate the assumption that an environment characterized by perceived autonomy support alone has the potential to satisfy all three psychological needs (see Mageau & Vallerand, 2003; Ryan & Solky, 1996). Our findings indicate that a coaching environment perceived to empower athletes with choices and decision-making (i.e., autonomy support), which conveys trust in their abilities whilst utilizing non-controlling feedback (i.e., competence support), and that takes and respects their perspective (i.e., relatedness support) would correspond to satisfaction of each of the three needs. In sum, the current findings coupled with past research (e.g., Adie et al., 2008; Smith et al., 2007) suggest that it might be beneficial for coaches to focus on utilizing the interpersonal behaviors associated with an autonomy supportive environment in terms of fostering the long-term satisfaction of the basic needs for autonomy, competence and relatedness, among their players.

Basic Need Satisfaction and Well- and Ill-Being

The present results partially supported the proposition that the basic needs are essential nutriment for optimal functioning and quality engagement (e.g., Deci & Ryan, 2000; Ryan & Deci, 2002). Similar to the results reported by Gagné et al. (2003), psychological need satisfaction explained within-person (but not between-person mean) variability in subjective vitality over the two seasons. More specifically, the competence and relatedness needs predicted increased within-person changes in vitality over time.

Unexpectedly, the autonomy need was unrelated to changes in players' feelings of enhanced energy and aliveness. There are several plausible explanations for this null finding. First, the measure of this need had low reliability across the first season (i.e., waves 1-3). This could have attenuated the relationship between the satisfaction of the need for autonomy and subjective vitality. Second, our measure appeared to capture the internal perceived locus of causality aspect of the autonomy need (deCharms, 1968). Based on arguments that the need for autonomy is a multi-

faceted concept (see Reeve, 2002), it could be the case that young soccer participants in a SoE value the choice/decision making aspect of their need for autonomy in terms of sustaining their feelings of positive energy over time. Future research could examine whether the choice/decision-making aspect of autonomy predicts sustained well-being of elite youth sport participants over time.

Lastly, the insignificant finding could have been the result of a statistical artifact. In other words, the competence and relatedness needs may have taken up much of the shared variance in the prediction of subjective vitality, especially considering the observed inter-relationships among the three needs. In order not to compromise the ecological validity of the results we modeled the three needs (both group-mean centered and average-person predictors for each need) together in a single model. However, the complexity of estimating this model may have meant that autonomy was overridden by the other two needs in the prediction of subjective vitality. When the autonomy need was modeled by itself it corresponded to both within-person changes ($B = .37; p < .001$) and between person mean differences ($B = .47; p < .001$) in subjective vitality. This latter finding is consistent with the assumptions of BNT (Ryan & Deci, 2002; Ryan & Frederick, 1997) and the results of previous BNT-based sport studies (e.g., Gagné et al., 2003; Reinboth & Duda, 2006). Although to be interpreted with caution, it suggests that perceptions of being the origin of one's actions (e.g., perceived satisfaction of the autonomy need) were relevant to these academy players feeling more energized and alive over the course of the two seasons.

Congruent with our hypotheses and previous youth sport research (e.g., Gagné et al., 2003), competence need satisfaction was associated with heightened levels of subjective vitality among the players across the two competitive soccer seasons. Aligned with other sport studies (e.g., Gagné et al., 2003; Reinboth et al., 2004), the present findings indicated the need for competence to be a key nutriment for the sustained functioning and psychological growth among the elite adolescent soccer players. More recent work conducted in youth soccer specifically has found participants highly concerned with skill development and task mastery (i.e., adopting a mastery approach goal) to exhibit higher levels of well-being (i.e., self-esteem) across competitive seasons (Adie et al., 2010).

Based on this body of literature, the current findings make intuitive sense in that players mastering and effectively interacting with their immediate environment (i.e., perceived competence need satisfaction) were accompanied by feelings of positive energy and aliveness.

The present results also indicated that fluctuations in relatedness with respect to one's team had positive implications in terms of the players' long term optimal functioning. Aligned with past findings in the sport domain (Adie et al., 2008; Gagné et al., 2003; Reinboth & Duda, 2006) and in support of theoretical predictions (Ryan & Deci, 2002), the degree of connectedness to and by others was found to be relevant to the experience of eudaimonic well-being among young academy soccer players across the two competitive seasons. Unlike previous research (Gagné et al., 2003), the need for relatedness did not predict between-person mean differences in vitality. The null finding maybe the result of net suppression given the interrelationships of the three needs. Future longitudinal research may wish to consider if the relatedness need predicts between-person mean variability in other indices of well-being (e.g., self-actualization) besides subjective vitality. Alternatively, subsequent studies conducted in youth sport may wish to consider the implications of the need for relatedness on well-being when it is measured with reference to different significant others (e.g., team mates, coach). Past research has shown that measuring relatedness in connection with the coach, as opposed to team mates, predicted feelings of vitality over time among university level student-athletes (Reinboth & Duda, 2006).

Ryan and Deci (2000) claimed that thwarting of any of the psychological needs can compromise one's sense of well-being and lead to ill-health. Contrary to past cross-sectional research in elite sport (e.g., Hodge, Lonsdale, & Ng, 2008; Lonsdale, Hodge, & Rose, 2009), the present results revealed limited support for this assumption. That is, only the interaction between time and the need for relatedness was observed to predict emotional and physical exhaustion among elite youth soccer participants. This finding suggests that male participants involved in a specialized soccer school need to develop close and respectful relationships with their team-mates as a potential strategy in order to reduce the risks of depleting their emotional and physical energy levels. There is

mixed evidence in the literature concerning the role of the psychological basic needs in predicting emotional and physical exhaustion. For example, studies conducted in sport (Adie et al., 2008; Hodge et al., 2008) have tended to find that lack of fulfillment for one or more psychological needs was (weakly) associated with higher levels of exhaustion, whereas no relationship emerged among participants in a dance context (e.g., Quested & Duda, 2010).

One way of interpreting the existent research findings in the physical domain is that psychological need satisfaction is more relevant to indices of well-being, as opposed to ill-being (e.g., Sheldon & Bettencourt, 2002). Preliminary evidence in the sport domain corroborates this argument (e.g., Adie et al., 2008; Gagné et al., 2003; Reinboth & Duda, 2006). However, it is also possible that the lack of (and mixed) findings observed in the sport-based BNT literature has to do with how need thwarting has been conceptualized and measured. Most studies (e.g., Hodge et al., 2008) to date have employed measures that capture the degree of psychological need satisfaction experienced. However, recent evidence suggests that it is wrong to assume that low need satisfaction is synonymous with high need-thwarting. In terms of tapping the latter construct, new work has indicated that directly assessing the degree of need-thwarting in the sport setting can predict indices of ill-being in sport much better than measures of need satisfaction (Bartholomew, Ntoumanis, Ryan, & Thøgersen-Ntoumani, 2011).

The Mediational Role of Basic Need Satisfaction

According to BNT (Deci & Vansteenkiste, 2004; Ryan & Deci, 2002), the basic psychological needs provide the means by which the perceived social environment facilitates or undermines indices of well- and ill-being. In extending past findings (e.g., Adie et al., 2008; Reinboth & Duda, 2006), the competence and relatedness needs partially mediated the perceived coaching environment-subjective vitality link. To maintain the sense of positive energy among adolescent soccer players, the present findings suggest that coaches should aim to sustain an environment that facilitates players' needs for competence and relatedness. In doing so, coaches

could aim to foster an environment that considers the perspective of the athlete, provides positive competence feedback, as well as affording choice and decision making on behalf of the athlete.

The three needs did not mediate the presumed link between perceived coach autonomy support and emotional and physical exhaustion. The results are consonant with the cross-sectional findings observed by Adie et al. (2008). Despite finding coach-autonomy support to be related to emotional and physical exhaustion across time, it is possible that other mechanisms are more relevant to explaining this relationship. It is possible that the degree of “need-thwarting” may potentially explain these links. Future research is warranted to address this hypothesis.

Limitations, Additional Future Research Directions and Conclusions

In terms of limitations, it is important to note that the present findings stem from correlational data. Although this study goes beyond cross-sectional results and examines patterns of relationships over time, cause and effect was not determined. Furthermore, it would strengthen the BNT literature in the athletic realm if subsequent research employed an experimental design to investigate the effects of the social environment created by significant others (e.g., coaches, peers and parents) on psychological need satisfaction and ensuing well-being. For example, researchers could manipulate coaching behaviors to reflect a perceived autonomy supportive environment focused on sustaining psychological need satisfaction and subsequent well-being.

A second limitation concerned the employment of self-report measures in the study. To advance research in this area, future work may consider objective measures (e.g., using physiological markers of well-being, such as cortisol response). Third, the sample in the present study comprised young male elite adolescent soccer players. The practical implications of our findings maybe limited to this population of sport participants, although Ryan and Deci (2002) claim the three psychological needs essential for well-being are invariant across age/gender groups and settings. This limitation is noted as current BNT evidence in the sport domain has underlined some subtle differences between studies across age groups and gender (Adie et al., 2008; Reinboth et al., 2004). Future research may wish to tease out why this variability occurs. As such, research

could test invariance of a BNT-based model hypothesizing a sequence of relationships linking the features of the perceived social environment, psychological needs and indices of well- and ill-being across male and female sport participants of different age groups.

In considering the implications of the present findings, it is also important to point out that we were only able to consider a two-level hierarchical structure to the data in this study. It is possible that variations in the variables of interest could be found at a higher level, such as the level of the team or of the sport. Unfortunately, the current sample size was not large or diverse enough to examine this postulate as it only comprised participants from a single SoE in soccer.

Whilst researchers have focused on the behaviors that characterize coach autonomy support, little is known regarding the antecedents that lead coaches to use an autonomy supportive style. Mageau and Vallerand (2003) have posited that coaches' perceptions of their athletes' motivation, among other antecedents, might be influential in the degree to which coaches manifest this type of interpersonal style or not. Research in PE has supported this assumption (e.g., Taylor & Ntoumanis, 2007), and it would be interesting for future studies to address this research gap in the sport domain.

To conclude, the present study is a valuable extension of BNT-based research conducted in the sport domain (Adie et al., 2008; Gagné et al., 2003). Overall, the findings provide evidence implicating the instrumental role of the perceived coaching environment in terms of the provision for ongoing autonomy support of basic need satisfaction and ensuing well-being among participants in an elite youth sport setting.

References

- Adie, J. W., Duda, J. L., & Ntoumanis, N. (2008). Autonomy support, basic need satisfaction, and the optimal functioning of adult male and female sport participants: A test of basic needs theory. *Motivation and Emotion, 32*, 189-199.
- Adie, J. W., Duda, J. L., Ntoumanis, N. (2010). Achievement goals, competition appraisals, and the psychological and emotional welfare of sport participants. *Journal of Sport & Exercise Psychology, 30*, 302-322.
- Baron, R. M., & Kenny, D. A. (1986). The moderator-mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology, 51*, 1173-1182.
- Bartholomew, K. J., Ntoumanis, N., Ryan, R. M., & Thøgersen-Ntoumani, C. (2011). Psychological need thwarting in the sport context: Development and initial validation of a psychometric scale. *Journal of Sport & Exercise Psychology, 33*, 75-102.
- Bartholomew, K. J., Ntoumanis, N., & Thøgersen-Ntoumani, C. (2010). The controlling interpersonal style in a coaching context: Development and initial validation of a psychometric scale. *Journal of Sport & Exercise Psychology, 32*, 193-216.
- Baumeister, R., & Leary, M. R. (1995). The need to belong: Desire for interpersonal attachments as a fundamental human motivation. *Psychological Bulletin, 117*, 497-529.
- deCharms, R. (1968). *Personal causation: The internal affective determinants of behavior*. New York: Academic Press.
- Deci, E. L., & Ryan, R. M. (1985). *Intrinsic motivation and self-determination in human behavior*. New York: Plenum Press.
- Deci, E. L., & Ryan, R. M. (1987). The support of autonomy and the control of behavior. *Journal of Personality and Social Psychology, 53*, 1024-1037.
- Deci, E. L., & Ryan, R. M. (2000). The “what” and “why” of goal pursuits: Human needs and the self-determination of behavior. *Psychological Inquiry, 11*, 227-268.

- Deci, E. L., & Vansteenkiste, M. (2004). Self-determination theory and basic need satisfaction: Understanding human development in positive psychology. *Ricerche di Psicologia*, 27, 23-40.
- Duda, J. L., & Balaguer, I. (2007). Coach-created motivational climate. In S. Jowett & D. Lavallee (Eds.), *Social psychology in sport* (pp. 117-130). Champaign, IL: Human Kinetics.
- Edmunds, J., Ntoumanis, N., & Duda, J. L. (2007). Adherence and well-being in overweight and obese patients referred to an exercise on prescription scheme: A self-determination theory perspective. *Psychology of Sport and Exercise*, 8, 722-740.
- Gagné, M., Ryan, R. M., & Bargmann, K. (2003). Autonomy support and need satisfaction in the motivation and well-being of gymnasts. *Journal of Applied Sport Psychology*, 15, 372-390.
- Gould, D., Tuffey, S., Udry, E., & Loehr, J. (1996). Burnout in competitive junior tennis players: II. Qualitative analysis. *The Sport Psychologist*, 10, 341-365.
- Hodge, K., Lonsdale, C., & Ng, J. Y. Y. (2008). Burnout in elite rugby: Relationships with basic psychological needs fulfillment. *Journal of Sports Sciences*, 26, 835-844.
- Kasser, V. G., & Ryan, R. M. (1999). The relation of psychological needs for autonomy and relatedness to vitality, well-being, and mortality in a nursing home. *Journal of Applied Social Psychology*, 29, 935-954.
- Krane, V., Greenleaf, C. A., & Snow, J. (1997). Reaching for gold and the price of glory: A motivational case study of an elite gymnast. *The Sport Psychologist*, 11, 53-71.
- Lemyre, P. N., Treasure, D. C., & Roberts, G. C. (2006). Influence of variability in motivation and affect on elite athlete burnout susceptibility. *Journal of Sport & Exercise Psychology*, 28, 32-48.
- Lonsdale, C., Hodge, K., & Rose, E. (2009). Athlete burnout in elite sport: A self determination perspective. *Journal of Sports Sciences*, 27, 785-795.
- Maas, C. J. M., & Hox, J. J. (2005). Sufficient sample sizes for multilevel modeling. *Methodology: European Journal of Research Methods for the Behavioral and Social Sciences*, 1, 85-91.

- Mageau, G. A., & Vallerand, R. J. (2003). The coach-athlete relationship: A motivational model. *Journal of Sport Sciences, 21*, 883-904.
- McAuley, E., Duncan, T., & Tammen, V. V. (1989). Psychometric properties of the intrinsic motivation inventory in a competitive sport setting: A confirmatory factor analysis. *Research Quarterly for Exercise and Sport, 68*, 20-32.
- Quested, E., & Duda, J. L. (2010). Exploring the social-environmental determinants of well- and ill-being in dancers: A test of basic needs theory. *Journal of Sport & Exercise Psychology, 32*, 39-60.
- Raedeke, T. D., & Smith, A. L. (2001). Development and preliminary validation of an athlete burnout questionnaire. *Journal of Sport & Exercise Psychology, 23*, 281-306.
- Rasbash, J., Steele, F., Browne, W.J. and Goldstein, H. (2009). *A User's Guide to MLwiN, v2.10*. Centre for Multilevel Modeling, University of Bristol.
- Ratelle, C. F., Larose, S., Guay, F., & Senécal, C. (2005). Perceptions of parental involvement and support as predictors of college students' persistence in a science curriculum. *Journal of Family Psychology, 19*, 286-293.
- Reeve, J. (2002). Self-determination theory applied to educational settings. In E. L. Deci & R. Ryan (Eds.), *Handbook of self determination research* (pp. 183-203). Rochester, NY: University of Rochester Press.
- Reinboth, M., & Duda, J. L. (2004). The motivational climate, perceived ability, and athletes' psychological and physical well-being. *The Sport Psychologist, 18*, 237-251.
- Reinboth, M., & Duda, J. L. (2006). Perceived motivational climate, need satisfaction and indices of well-being in team sports: A longitudinal perspective. *Psychology of Sport and Exercise, 7*, 269-286.
- Reinboth, M., Duda, J. L., & Ntoumanis, N. (2004). Dimensions of coaching behavior, need satisfaction, and the psychological and physical welfare of young athletes. *Motivation and Emotion, 8*, 297-313.

- Richer, S., & Vallerand, R. J. (1998). Construction and validation of the perceived relatedness scale. *Revue Européenne de Psychologie Appliquée*, 48, 129-137.
- Ryan, R. M., & Deci, E. L. (2000). The darker and brighter sides of human existence: Basic psychological needs as a unifying concept. *Psychological Inquiry*, 11, 319–338.
- Ryan, R. M., & Deci, E. L. (2001). On happiness and human potentials: A review of research on hedonic and eudaimonic well-being. *Annual Review of Psychology*, 52, 141-166.
- Ryan, R. M., & Deci, E. L. (2002). An overview of self-determination theory. In E. L. Deci & R. M. Ryan (Eds.), *Handbook of self-determination research* (pp. 3-33). Rochester, NY: University of Rochester Press.
- Ryan, R. M., & Frederick, C. M. (1997). On energy, personality and health: Subjective vitality as a dynamic reflection of well-being. *Journal of Personality*, 65, 529-565.
- Ryan, R. M., Huta, V., & Deci, E. L. (2008). Living well: A self-determination theory perspective on eudaimonia. *Journal of Happiness Studies*, 9, 139-170.
- Ryan, R. M., & Solky, J. A. (1996). What is supportive about social support? On the psychological needs for autonomy and relatedness. In G. R. Pierce, B. R. Sarason, & I. G. Sarason (Eds.), *Handbook of social support and the family* (pp. 249-266). New York: Plenum.
- Sheldon, K. M., & Bettencourt, B. A. (2002). Psychological need-satisfaction and subjective well-being within social groups. *British Journal of Social Psychology*, 41, 25-38.
- Sheldon, K. M., Elliot, A. J., Kim, Y., & Kasser, T. (2001). What is satisfying about satisfying events? Testing 10 candidate psychological needs. *Journal of Personality and Social Psychology*, 80, 325-339.
- Singer, J. D. & Willett, J. B. (2003). *Applied longitudinal data analysis: Modeling change and event occurrence*. New York: Oxford University Press.
- Smith, A. L., Ntoumanis, N., & Duda, J. L. (2007). Goal striving, goal attainment, and well-being: An adaptation and testing of the self-concordance model in sport. *Journal of Sport & Exercise Psychology*, 29, 763-782.

- Standage, M., Duda, J. L., & Ntoumanis, N. (2006). Students' motivational processes and their relationship to teacher ratings in school physical education: A self-determination approach. *Research Quarterly for Exercise and Sport*, 77, 100-110.
- Tabachnick, B. G., & Fidell, L. S. (2007). *Using multivariate statistics* (5th ed.). Boston, MA: Allyn and Bacon.
- Taylor, I., & Ntoumanis, N. (2007). Teacher motivational strategies and student self-determination in physical education. *Journal of Educational Psychology*, 99, 747-760.
- Waterman, A. S. (1993). Two conceptions of happiness: Contrasts of personal expressiveness (eudaimonia) and hedonic enjoyment. *Journal of Personality and Social Psychology*, 64, 678-691.
- White, R. W. (1959). Motivation reconsidered: The concept of competence. *Psychological Review*, 66, 297-333.
- Williams, G. C., Grow, V. M., Freedman, Z. R., Ryan, R. M., & Deci, E. L. (1996). Motivational predictors of weight loss and weight-loss maintenance. *Journal of Personality and Social Psychology*, 70, 115-126.

1 Table 1

2 *Descriptive Statistics, Internal Reliabilities, and Bivariate Correlations for the Study*3 *Variables*

Variable	1	2	3	4	5	6
Beginning of Season One (Wave 1; $n = 91$)						
1) Autonomy Support	(.87)					
2) Autonomy	.27*	(.65)				
3) Competence	.12	.11	(.77)			
4) Relatedness	.38**	.22*	.14	(.88)		
5) Subjective Vitality	.42**	.10	.31**	.35**	(.89)	
6) Exhaustion	-.25*	-.03	-.05	-.11	-.31**	(.87)
<i>M</i>	5.21	3.33	5.59	4.11	5.43	1.91
<i>SD</i>	.91	.79	.73	.66	.94	.76
Middle of Season One (Wave 2; $n = 88$)						
1) Autonomy Support	(.89)					
2) Autonomy	.50**	(.64)				
3) Competence	.41**	.42**	(.76)			
4) Relatedness	.68**	.43**	.41**	(.91)		
5) Subjective Vitality	.55**	.32**	.30**	.35**	(.84)	
6) Exhaustion	-.21	-.04	-.18	-.10	-.32**	(.92)
<i>M</i>	5.40	3.60	5.66	4.22	5.60	2.03
<i>SD</i>	.92	.70	.76	.70	.88	.85
End of Season One (Wave 3; $n = 78$)						
1) Autonomy Support	(.88)					
2) Autonomy	.40**	(.60)				
3) Competence	.39**	.12	(.74)			
4) Relatedness	.52**	.37**	.37**	(.90)		
5) Subjective Vitality	.61**	.30**	.40**	.37**	(.86)	
6) Exhaustion	-.30**	-.07	-.32**	-.17	-.25*	(.94)
<i>M</i>	5.36	3.54	5.65	4.24	5.63	2.31
<i>SD</i>	.96	.70	.90	.76	.95	1.01
Beginning of Season Two (Wave 4; $n = 62$)						
1) Autonomy Support	(.90)					
2) Autonomy	.53**	(.82)				
3) Competence	.31*	.14	(.81)			
4) Relatedness	.62**	.41**	.24	(.90)		
5) Subjective Vitality	.37**	.13	.38**	.32*	(.81)	
6) Exhaustion	-.06	.01	.03	-.09	-.07	(.94)
<i>M</i>	5.31	3.40	5.75	4.20	5.69	2.31
<i>SD</i>	1.05	.89	.73	.78	.86	1.01
Middle of Season Two (Wave 5; $n = 61$)						
1) Autonomy Support	(.92)					
2) Autonomy	.16	(.68)				
3) Competence	.14	.09	(.84)			
4) Relatedness	.55**	.31*	.11	(.88)		
5) Subjective Vitality	.25*	.35**	.24	.31*	(.85)	
6) Exhaustion	-.22	-.07	-.14	-.39**	-.18	(.94)

<i>M</i>	5.10	3.39	5.86	4.40	5.60	2.36
<i>SD</i>	1.07	.73	.78	.69	1.02	.98
End of Season Two; (Wave 6; N=54)						
1) Autonomy Support	(.90)					
2) Autonomy	.50**	(.69)				
3) Competence	.29*	.24	(.69)			
4) Relatedness	.69**	.47**	.41**	(.92)		
5) Subjective Vitality	.59**	.47**	.53**	.54**	(.81)	
6) Exhaustion	-.34*	-.12	-.14	-.18	-.38**	(.92)
<i>M</i>	5.11	3.60	5.88	4.25	5.68	2.24
<i>SD</i>	1.28	.70	.75	.74	1.07	.89
Average Across All Waves (N=54)						
1) Autonomy Support	(.90)					
2) Autonomy	.50**	(.68)				
3) Competence	.29**	.24*	(.77)			
4) Relatedness	.65**	.54**	.32**	(.90)		
5) Subjective Vitality	.54**	.30**	.35**	.48**	(.84)	
6) Exhaustion	-.32**	-.13	-.23*	-.28**	-.36**	(.92)
<i>M</i>	5.23	3.44	5.68	4.20	5.57	2.14
<i>SD</i>	.74	.49	.52	.50	.70	.64

Notes. The values on the diagonal represent Cronbach's alpha coefficients. Autonomy Support = Athletes' perceptions of autonomy support provided by the coach; Exhaustion = Emotional and physical exhaustion.

* $p < .05$; ** $p < .01$.

Table 2

Basic Need Satisfaction (Controlling for Perceived Coach Autonomy Support) Predicting Well- and Ill-Being (Model D)

Predictor	Subjective Vitality		Exhaustion	
	<i>B</i>	SE	<i>B</i>	SE
Intercept	5.47	0.12***	1.82	0.09***
Slope for time (linear)	0.25	0.12*	0.35	0.12**
Slope for time (quadratic)	-0.03	0.02	-0.04	0.02*
Within-person level				
Autonomy support	0.25	0.05***	-0.09	0.05
Autonomy	0.01	0.06	0.03	0.06
Competence	0.24	0.06***	-0.03	0.06
Relatedness	0.22	0.08***	-0.04	0.08
Between-person level				
Autonomy support	0.30	0.19	-0.29	0.17
Autonomy	0.04	0.21	-0.05	0.19
Competence	0.22	0.18	-0.02	0.17
Relatedness	0.21	0.25	-0.16	0.23
Interactions with slope for time (Linear)				
Autonomy support	-0.13	0.17	0.42	0.17**
Autonomy	-0.09	0.19	-0.13	0.19
Competence	0.13	0.20	0.09	0.20
Relatedness	-0.11	0.25	-0.48	0.25
Interactions with slope for time (Quadratic)				
Autonomy support	-0.01	0.02	-0.06	0.02***
Autonomy	0.02	0.03	0.03	0.03
Competence	0.00	0.03	-0.02	0.03
Relatedness	0.01	0.03	0.08	0.03**

Notes. Autonomy Support = Athletes' perceptions of autonomy support provided by the coach; Exhaustion = Emotional and physical exhaustion.

* $p < .05$; ** $p < .01$; *** $p < .001$